COGNITION AND STUDENT LEARNING RESEARCH GRANTS

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Institute of Education Sciences
http://www.ed.gov/offices/IES/funding.html

LETTER OF INTENT RECEIPT DATE: January 29, 2003

APPLICATION RECEIPT DATE: March 21, 2003

THIS REQUEST FOR APPLICATIONS CONTAINS THE FOLLOWING INFORMATION:

Request for Applications

The Institute of Education Sciences invites applications for research projects that will contribute to its research program on Cognition and Student Learning. For this competition, the Institute will consider only applications that meet the requirements outlined below under the section on Requirements of the Proposed Research.

Purpose of the Research Program

The purpose of the program of research on Cognition and Student Learning is to improve student learning by bringing recent advances in cognitive science and neuroscience to bear on significant educational problems. The Institute intends this program to establish a scientific foundation for educational practice by supporting research on key processes of attention, memory, and reasoning that are essential for learning and that are likely to produce substantial gains in academic achievement.

Background

The most important outcome of education is student learning. Recent advances in understanding learning have come from cognitive science and neuroscience research, but these advances have not been widely or systematically tapped in education. The program of research on Cognition and Student Learning seeks to establish a scientific foundation for educational practice by building on these theoretical and empirical advances and applying them to significant problems in academic achievement. The Institute is conducting this grant competition to establish a stream of research bridging basic cognitive science and educational application. Cognitive science, including studies of memory, decision-making, language acquisition, higher order thinking skills, as well as the brain mechanisms underlying these abilities, has shown explosive growth in the last 25 years. Indeed, along with genomic science, many believe that the cognitive and brain sciences have generated the greatest scientific progress of the late 20th century. Basic research within the disciplines of psychology, linguistics, and neuroscience has generated new and important fundamental knowledge on how people learn. However, most of this research has been conducted in laboratory settings, with samples of convenience, and with tasks that are artificial. This program of research sponsored by the Institute will direct research in the cognitive and brain sciences to solving problems in schools, demystifying educational practices and programs to replicate successes, and developing new programs and interventions that take advantage of cutting-edge research on the science of learning.

In order for students to succeed in school, they must attend to, remember, and reason effectively about information, whether that information is provided by teachers, textbooks, or via computers. These three components of cognition are the basis for achievement in reading, science, mathematics, and other school subjects.

Attention: Research has identified complex attentional mechanisms at the neural and behavioral level that govern information encoding, and how encoding changes with age. Little is known, however, about the encoding of information presented to students, notably, how much information is encoded, how attentional mechanisms are implicated in failures to encode, and the degree to which encoding failure explains academic failure, particularly among students who are not diagnosed with attention deficit disorder. The effectiveness of teaching and learning interventions depends on whether students process those interventions, that is, on the quality and degree of student attention. Research is needed that bridges the gap between detailed, rigorous models of attention (and its development) and successful academic performance.

Memory: Memory, especially long-term retention of learning, is a key outcome of education, necessary for progress in related subject matter across grades and, ultimately, for preparation for the workforce or higher education. In addition, thinking, problem solving, comprehension, judgment, and decision-making are all related to memory. Even the simplest school tasks call on short-term, or working, memory as well as long-term memory. Although research has identified practical strategies for improving memory and long-term retention, and has linked memory to individual differences in test performance, few educational interventions harness what we know about memory to help students learn. Recent discoveries about multiple memory systems, and their underlying neural processes, hold particular promise for developing instructional methods that tap implicit learning. Thus, research is needed on how to improve retrieval of implicit memories for learned material, how memory representations can better reflect what has been taught, and how the flexible use of memory systems can facilitate accurate reasoning and problem solving.

Reasoning: Rudimentary reasoning is required for students to comprehend textbooks, follow class lectures and discussions, and write and think effectively on their own. Research has distinguished different kinds of reasoning errors in laboratory tasks and effective methods for reducing some of these errors. Moreover, research has shown that students are not trapped in cognitive stages until they are "ready to learn," but, rather, that they can learn to improve their reasoning at each stage of development. Research is needed that links this work on reasoning and its development to the improvement of reasoning performance in important academic contexts. As the nation continues to shift to a knowledge-based economy, students who fail to master these higher-order reasoning skills are unlikely to compete effectively in a fast-moving economy in which new learning and problem solving are routinely required.

Requirements of the Proposed Research

Applications are requested that address basic or higher-order cognitive processes, and which link those processes to improving important student outcomes. In considering outcomes for study, applicants must choose those that pertain to major national problems in education, such as underachievement in reading, mathematics, science, writing, and English language literacy, or the lack of other skills and knowledge necessary to fully participate in a democracy or to contribute productively to the workforce. Other important outcomes include social ills that are intertwined with educational problems, such as delinquency and drug abuse. (If social outcomes are studied, they must be analyzed in relation to education variables.) Applicants should explicitly describe how the proposed research would advance solutions to such major national challenges in education.

Applicants must propose to study basic or higher-order cognitive processes, which include attention; working memory; learning processes (acquisition and retention); storage in and retrieval from long-term memory; interference and inhibition; executive function and monitoring; metamemory or memory strategies; meaning extraction (literal and figurative) for words, sentences, and discourse; inference and critical thinking (semantic, logical, and pragmatic inferences, situation models, and other mental representations); similarity, categorization, and analogical reasoning; non-verbal reasoning (e.g., spatial, scientific, and quantitative reasoning);

domain-specific knowledge (e.g., biology, calculus, or American history) and conceptual development; and judgment and decision-making.

Research should apply or extend basic research findings or empirically supported theory to practical problems in education. Applicants must develop relationships with schools (or other education delivery settings). Applicants are required to document the availability and cooperation of the schools or other education delivery settings that will be required to carry out the research proposed in the application via a letter of support from the education organization(s). Applicants are not required to conduct all studies in education delivery settings, but at least some of the research must be conducted in an educational setting. For example, research might shift between studies conducted in the laboratory and those conducted in a school. However, the relevance of research conducted in laboratory settings to the problems of application should be clear conceptually and should be demonstrated empirically over the course of the proposed research project. Regardless of the site of the studies, the intent of this research should be to bring cognitive science to bear on the problems of schools, to enhance instruction, or to promote or better assess learning. Domains of application include (but are not limited to) tutoring, instructional technology, educational attainment, mastery of academic subject matter (e.g., reading, science, or mathematics), English language learning and literacy, closing the achievement gap for low-income children, and teacher preparation and quality. For example, a project might examine how fluid intelligence and domain-specific knowledge mediate the effectiveness of particular curricula in science or mathematics. The results would provide specific guidance in assigning students to different curricula to achieve better educational outcomes. To take another example, research might be aimed at testing the generality of design principles for instructional technology derived from basic cognitive research that would be useful to teachers and curriculum designers. Or, to take a further example, research might focus on the assessment of dual processes in memory and their differential contributions to success in academic tasks, and the development of instructional techniques that facilitate the use of processes that promote success.

Because research in real-world environments can challenge theories and understanding of cognition that have been developed in laboratory settings, research can also be designed to uncover the underlying processes and mechanisms that govern student learning. Understanding the learning process enables educators to generalize results to the appropriate students and subject matter, to inhibit inappropriate generalization, and to design more powerful educational techniques. Such research might address the cognitive components of important educational activities, such as reading a social studies textbook or solving algebra problems, or the reasons why certain educational techniques foster better results.

Research proposed under this competition must be motivated by a theoretical framework and relevant prior empirical evidence, both of which must be well articulated. Research questions or hypotheses must be clearly specified. In the description of the design of the studies (e.g., experimental, quasi-experimental, correlational, descriptive), independent and dependent, or predictor and criterion, or descriptive and explanatory variables should be distinguished and methods for providing reliable measures of each variable should be detailed. It is essential that the research methods be appropriate to the specified research questions or hypotheses. For example, where causal connections are to be tested, studies incorporating experimental designs

with randomized assignment generally provide the strongest tests of the hypotheses. Descriptions of the design and data analysis strategies must provide sufficient detail for reviewers to determine if the research questions are appropriately addressed. In addition, if the research is intended to test hypotheses, the design should make it possible, in principle, to obtain results that disconfirm the hypotheses. Any approach must incorporate a valid process that allows for generalizations beyond the study participants. For research including interventions conducted in education settings, methods and measures for tracking implementation of the intervention should also be described.

Applications Available

Application forms and instructions for the electronic submission of applications will be available for this program of research no later than February 21, 2003, from the following web site:

http://ies.asciences.com

Mechanism of Support

The Institute intends to award grants for periods up to 36 months pursuant to this request for applications.

Funding Available

The Institute may award up to 12 grants as a result of this competition and expects that the typical award will be approximately $250,000 per year for 3 years. Although the plans of the Institute include this program of research, awards pursuant to this request for applications are contingent upon the availability of funds and the receipt of a sufficient number of meritorious applications.

Eligible Applicants

Applicants that have the ability and capacity to conduct scientifically valid research are eligible to apply. Eligible applicants include, but are not limited to, non-profit and for-profit organizations and public and private agencies and institutions, such as colleges and universities.

Special Requirements

Applicants should budget for two meetings each year in Washington, DC, with other grantees and Institute staff. At least one project representative should attend each one-day meeting.

Letter of Intent

A letter indicating a potential applicant's intent to submit an application is optional, but encouraged, for each application. The letter of intent is to be sent by the date listed at the beginning of this document and should indicate -- in the email subject line -- the title of the program of research covered by this request for applications and the number of the request. The title and the number of this request for

applications are also specified at the beginning of this document. Receipt of the letter of intent will be acknowledged by e-mail.

The letter of intent should not exceed one page in length and should include a descriptive title and brief description of the research project; the name, institutional affiliation, address, telephone number and e-mail address of the principal investigator(s); and the name and institutional affiliation of any key collaborators. The letter of intent should indicate the duration of the proposed project and provide an estimated budget request by year, and a total budget request. Although the letter of intent is optional, is not binding, and does not enter into the review of subsequent applications, the information that it contains allows Institute staff to estimate the potential workload to plan the review. The letter of intent should be submitted by e-mail to:

IES-LOI@asciences.com

Submitting an Application

Applications must be submitted electronically by the application receipt date, using the ED standard forms and the instructions provided at the following web site:

http://ies.asciences.com

Potential applicants should check this site as soon as possible after February 21, 2003, when application forms and instructions first become available, for information about the electronic submission procedures that must be followed and the software that will be required.

The application form approved for this program is OMB Number 1890-0009.

Contents and Page Limits of Application

The application must include the following sections: (1) title page form (ED 424); (2) budget summary form (ED 524); (3) one-page abstract; (4) research narrative; (5) references; (6) curriculum vitae for principal investigators(s) and other key personnel (limited to 3 pages each and including only information sufficient to demonstrate that personnel possess training and expertise commensurate with their duties); (7) narrative budget justification; and (8) appendix.

The one-page *abstract* must include: The title of the project and brief descriptions of (1) the purpose of the project or the educational problem that will be addressed; (2) the population(s) from which the participants of the study(ies) will be sampled (age groups, race/ethnicity, SES); (3) the proposed research method(s); and (4) the proposed intervention if one has been proposed.

Incorporating the requirements outlined under the section on Requirements of the Proposed Research, the *research narrative* provides the majority of the information on which reviewers will evaluate the proposal and should address:

(a) Significance of the Project
   (1) Identify the educational problem that will be addressed by the study and describe the contribution the study will make to a solution to that problem.

(b) Approach
   (1) Provide a theoretical framework and review relevant prior empirical evidence supporting the proposed project. For projects in which an intervention is proposed, include a description of the intervention along with the conceptual rationale and empirical evidence supporting the intervention;
   (2) Include clear, concise hypotheses or research questions;
   (3) Present a clear description of, and a rationale for, the sample or study participants, including justification for exclusion and inclusion criteria and, where groups or conditions are involved, strategies for assigning participants to groups;
   (4) Provide clear descriptions of, and rationales for, data collection procedures and measures to be used; and
   (5) Present a detailed data analysis plan that justifies and explains the selected analytic strategy, shows clearly how the measures and analyses relate to the hypotheses or research questions, and indicates how the results will be interpreted. Quantitative studies should, where sufficient information is available, include a power analysis to provide some assurance that the sample is of sufficient size.

(c) Personnel
   (1) Include brief descriptions of the qualifications of key personnel (information on personnel should also be provided in their curriculum vitae).

(d) Resources
   (1) Provide a description of the resources available to support the project at the applicant's institution and in the field settings in which the research will be conducted.

The research narrative (text plus all figures, charts, tables, and diagrams) is limited to the equivalent of 25 pages, where a "page" is 8.5 in. x 11 in., on one side only, with 1 inch margins at the top, bottom, and both sides. Double space (no more than 3 lines per vertical inch) all text in the research narrative. Use a font that is either 12-point or larger, or no smaller than 10 pitch (i.e., 10 characters per inch).

The 25-page limit does not apply to the title page form, the one-page abstract, the budget summary form and narrative budget justification, the curriculum vitae, references, or the assurances and certifications.

Reviewers are able to conduct the highest quality review when applications are concise and easy to read, with pages numbered consecutively.

The *budget justification* must provide sufficient detail to allow reviewers to judge whether reasonable costs have been attributed to the project. It must include the time commitments and brief descriptions of the responsibilities of key personnel.

The *appendix* must include letters of agreement from all partners (e.g., schools) and consultants. Each letter should include enough information to make it clear that the author of the letter

understands the nature of the commitment of time, space, and resources to the research project that will be required if the application is funded. The appendix is limited to 15 pages.

Application Processing

Applications must be received by 11:59 p.m. Eastern time on the application receipt date listed in the heading of this request for applications. Upon receipt, each application will be reviewed for completeness and for responsiveness to this request for applications. Incomplete applications and applications that do not address specific requirements of this request will be returned to the applicants without further consideration.

Peer Review Process

Applications that are complete and responsive to this request will be evaluated for scientific and technical merit. Reviews will be conducted in accordance with the review criteria stated below.

Each application will be assigned to at least two primary reviewers who will complete written evaluations of the application, identifying strengths and weaknesses related to each of the review criteria. Primary reviewers will independently assign a score for each criterion, as well as an overall score, for each application they review. Based on the overall scores assigned by primary reviewers, an average overall score for each application will be calculated and a preliminary rank order of applications prepared before the full peer review panel convenes to complete the review of applications.

The 30 applications deemed to have the highest merit, as reflected by the preliminary rank order, will be reviewed by a full panel of approximately 20 individuals who have substantive and methodological expertise appropriate to the program of research and request for applications, and who served as primary reviewers for individual applications. An individual reviewer may propose to the full panel that a particular application that does not score among the top 30 in the preliminary scoring but which the reviewer believes merits consideration should also be reviewed. The panel will decide whether to review any such application.

All members of the peer review panel will be expected to review the 30 applications being considered by the panel. Following presentations by the primary reviewers and discussion by the full panel, each member of the peer review panel will score each application, assigning a score for each criterion, as well as an overall score. In addition, reviewers will indicate whether or not an application is recommended for funding.

Review Criteria

The goal of Institute-supported research is to contribute to the solution of educational problems and to provide reliable information about the educational practices that support learning and improve academic achievement and access to educational opportunities for all students. Reviewers will be expected to assess the following aspects of an application in order to judge the likelihood that the proposed research will have a substantial impact on the pursuit of that goal. Information pertinent to each of these criteria is also described above in the section on

Requirements of the Proposed Research and in the description of the research narrative, which appears in the section on Contents and Page Limits of Application.

- Significance (importance of the addressed problem, contribution of project to solution of the problem)
- Approach (conceptual rationale, hypotheses or research questions, measures, research design, analytic methods)
- Personnel (qualifications of project staff)
- Resources (support at applicant's institution and at field settings)

Strong applications for Cognition and Student Learning Research Grants clearly address each of the review criteria. They make a well-reasoned and compelling case for the significance of the project and the problems or issues that will be the subject of the proposed research. They present a research design (approach) that is complete and clearly delineated, and that incorporates sound research methods. In addition, the personnel descriptions included in strong applications make it apparent that the project director, principal investigator, and other key personnel possess training and experience commensurate with their duties. Descriptions of facilities, equipment, supplies, and other resources demonstrate that they are adequate to support the proposed activities. Commitments of each partner show support for the implementation and success of the project.

Receipt and Review Schedule

Letter of Intent Receipt Date: January 29, 2003
Application Receipt Date: March 21, 2003
Peer Review Date: May 15-16, 2003
Earliest Anticipated Start Date: August 1, 2003

Award Decisions

The following will be considered in making award decisions:

- Scientific merit as determined by the peer review
- Responsiveness to the requirements of this request
- Performance and use of funds under a previous Federal award
- Contribution to the overall program of research described in this request
- Availability of funds

Direct your questions to:

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Email: Elizabeth.Albro@ed.gov
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PROGRAM AUTHORITY: 20 U.S.C. 5501 et seq., the "Education Sciences Reform Act of 2002," Title I of Public Law 107-279, November 5, 2002. This program is not subject to the intergovernmental review requirements of Executive Order 12372.

APPLICABLE REGULATIONS: The Education Department General Administrative Regulations (EDGAR) in 34 CFR parts 74, 77, 80, 81, 82, 85, 86 (part 86 applies only to Institutions of Higher Education), 97, 98, and 99. In addition, 34 CFR part 75 is applicable, except for the provisions in 34 CFR 75.102, 75.103, 75.105, 75.109(a), 75.200, 75.201, 75.209, 75.210, 75.217, 75.219, 75.220, and 75.230.